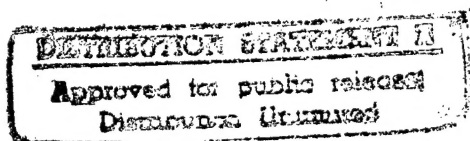


# ENERGY SAVING OPPORTUNITIES SURVEY ESOS

West Point  
Pre-Final Submittal

AUGUST 1986

Contract No. DACA 31-81-C-0112



For  
The Baltimore District  
Corps of Engineers

VOLUME I of VI  
NARRATIVE REPORT

BERNARD JOHNSON INCORPORATED  
ARCHITECTS ENGINEERS PLANNERS  
6500 ROCK SPRING DR. BETHESDA, MARYLAND 20817

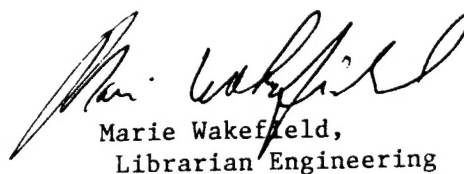


DEPARTMENT OF THE ARMY  
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS  
P.O. BOX 9005  
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Marie Wakefield,  
Librarian Engineering

## EXECUTIVE SUMMARY

### I. INTRODUCTION

In the winter of 1980, the Army Corp of Engineers (COE), Baltimore District, advertised through the Commerce Business Daily for the services of an A/E firm with expertise in performing energy conservation surveys. The services of Bernard Johnson Incorporated (BJI) were retained in May, 1981, under contract number DACA-31-81-C-0112.

The purpose of this contract is to investigate a number of buildings, identified within the scope of work, for a set of energy conservation projects and determine their economic feasibility on a life-cycle basis.

Notice to proceed for West Point was issued by the Baltimore COE on September 2, 1983. Field surveys began in October of 1983 leading to preliminary submittal in January, 1984. The preliminary report provided the user with the results of the screening analysis of the projects within the scope of work based on the surveys. The Interim report submitted in August 1984 included energy saving and cost analyses representing approximately 70% of the entire effort.

This report represents the Pre-Final submittal of West Point Energy Savings Opportunities Survey (ESOS). It is an update of the Interim Report, which incorporates the review comments, as well as, completes over 95% of all saving and cost calculations for the energy conservation options for each building and provides programming documentation.

Developed projects have resulted in total annual energy savings of 176,600 MBTU which constitutes nearly 11.3% of the total energy consumption of West Point, at an estimated construction cost of \$3,838,000. Implementation of energy conservation options are expected to produce an annual dollar saving on the order of \$1,154,000.

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West Point Pre-Final Report has been organized into five volumes:

o Volume I - has been subdivided into five sections.

- Section 1 - Provides all the background information, methods of approach, and the economic parameters used to develop the projects.
- Section 2 - Provides a brief description for every building within the scope of work, including the architecture of the building and the HVAC systems utilized. Additionally, building description section is used to account for all the projects within the scope of work and the results of the analyses. Section 2 also provides the summary of the results in a tabulated fashion.
- Section 3 - Provides the energy consumption and cost figures for West Point.
- Section 4 - Provides the report distribution list.
- Section 5 - Provides the base site plan

o Volumes II and III

Provides 1391 and 4283 programming documents for all projects which were determined to be economically feasible.

o Volumes IV, V, and VI

Provide the method of calculations, all the back-up calculations including energy savings analyses, cost estimates, life-cycle cost analyses.

## II WEST POINT ENERGY CONSUMPTION

A summary of West Point facilities energy consumption for FY-81, FY-82, and FY-83 is shown in Table 1. This table indicates that energy consumption at the installation has dropped from FY 81 to FY 83 by 2.7%.

Figure 1 illustrates the total fixed facilities energy use at West Point by fuel type during FY 83. Electricity accounted for 37.9% of the total energy used, while natural gas accounted for 6.6%, oil #2 6.6% and oil #6 48.8% of the total energy consumption.

FIGURE 1

WEST POINT ENERGY CONSUMPTION BREAKDOWN FISCAL YEAR 1983 (MBTU)

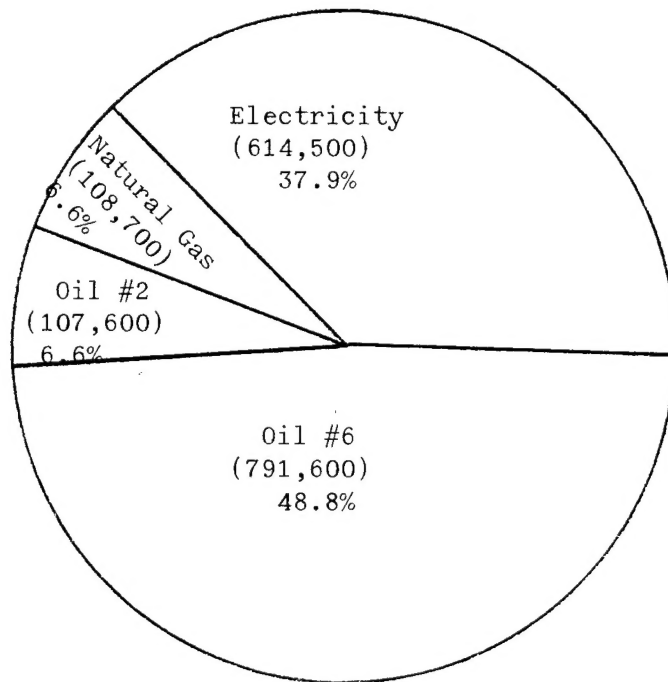


TABLE 1  
West Point's Energy Use  
Fiscal Year 81 through Fiscal Year 83

| FUEL TYPE   | FY 81<br>(MBTU) | FY 82<br>(MBTU) | FY 83<br>(MBTU) |
|-------------|-----------------|-----------------|-----------------|
| Electricity | 581,700         | 596,800         | 614,500         |
| Natural Gas | 127,800         | 128,500         | 108,700         |
| Fuel Oil #2 | 108,200         | 120,200         | 107,200         |
| Fuel Oil #6 | <u>850,100</u>  | <u>856,500</u>  | <u>791,600</u>  |
| TOTAL       | 1,667,800       | 1,702,000       | 1,622,000       |

### III. ENERGY CONSERVATION MEASURES DEVELOPED

Energy Savings Opportunities Survey (ESOS) conducted at West Point required investigation of a number of energy conservation measures. A total of 195 projects were found to be economically feasible based on life-cycle-cost analysis of about 460 projects. The feasible projects were then packaged, based on similarities, into 1391 and 4283 programming documents. A total of twelve 1391's and five 4283's were developed, which have been presented in Volumes II and III of this report.

Table 3 provides tabulated results of the feasible projects on a building basis, prioritized in the order of descending Savings-Investment-Ratio (SIR).

Table 4 provides tabulated results of the feasible projects from Table 3, which were packaged into 1391's and 4283's. The projects have been prioritized on the order of descending Savings-Investment-Ratio (SIR).

**TABLE 2**  
**PRIORITIZED LISTING OF**  
**FEASIBLE PROJECTS**  
**ON A BUILDING BASIS**

| Bldg. | Energy Conservation Measure | COST                | SAVINGS           |                           | SIR   | Feasible?<br>(Yes/No) |
|-------|-----------------------------|---------------------|-------------------|---------------------------|-------|-----------------------|
|       |                             | Const Costs<br>(\$) | Annual<br>MBTU/YR | BTU/FT <sup>2</sup><br>YR |       |                       |
| 149   | Hot Water Temp Reduction    | 6                   | 17.83             | 207                       | 151.2 | Yes                   |
| 600   | Hot Water Temp Reduction    | 11                  | 4.8               | 57                        | 18.1  | Yes                   |
| 601   | Air Volume Reduction        | 15,860              | 2,967.8           | 8,205                     | 13.2  | Yes                   |
|       | Enthalphy Economizer        | 30,364              | 1,069.2           | 2,956                     | 2.9   | Yes                   |
|       | Outside Air Reduction       | 10,997              | 846.6             | 2,340                     | 2.1   | Yes                   |
| 603   | Air Volume Reduction        | 597                 | 342               | 8,321                     | 40.5  | Yes                   |
|       | Outside Air Reduction       | 11,267              | 3,743             | 90,998                    | 28.5  | Yes                   |
|       | Induction Kitchen Hood      | 21,828              | 1,719             | 41,825                    | 7.0   | Yes                   |
|       | Enthalpy Economizer         | 8,677               | 656               | 15,961                    | 6.7   | Yes                   |
|       | Piping Insulation           | 628                 | 23.05             | 560                       | 3.2   | Yes                   |
|       | Multi-Set Back              | 12,011              | 364               | 8,856                     | 2.7   | Yes                   |
|       | Lighting                    | 25,355              | 515.6             | 12,544                    | 1.1   | Yes                   |
|       | Inside Insulation           | 32,546              | 369.96            | 9,001                     | 1.0   | Yes                   |
| 604   | High Efficiency Fluorescent | 5,520               | 175.9             | 4,343                     | 1.8   | Yes                   |
| 605   | H.W. Temp. Reduction        | 6                   | 8.05              | 164                       | 82.0  | Yes                   |
|       | Zone Control                | 4,410               | 132               | 2,677                     | 2.6   | Yes                   |
|       | Multi-Set Back              | 15,141              | 271               | 5,497                     | 1.6   | Yes                   |
| 606   | Outside Air Reduction       | 3,995               | 753.47            | 6,535                     | 16.4  | Yes                   |
| 618   | Roof Insulation             | 14,523              | 172.96            | 12,267                    | 1.0   | Yes                   |



TABLE 2

| Bldg.  | Energy Conservation Measure | COST                | SAVINGS           |                           | SIR   | Feasible?<br>(Yes/No) |
|--------|-----------------------------|---------------------|-------------------|---------------------------|-------|-----------------------|
|        |                             | Const Costs<br>(\$) | Annual<br>MBTU/YR | BTU/FT <sup>2</sup><br>YR |       |                       |
| 620    | Hot Water Temp Reduction    | 6                   | 14.29             | 234                       | 145.4 | Yes                   |
|        | Piping Insulation           | 341                 | 56.33             | 1,055                     | 15.6  | Yes                   |
|        | Ceiling Insulation          | 11,652              | 595.98            | 9,770                     | 4.4   | Yes                   |
|        | Multi-Set Back              | 4,661               | 164               | 2,689                     | 3.1   | Yes                   |
|        | Zone Control                | 9,045               | 124               | 2,033                     | 1.2   | Yes                   |
|        | Inside Insulation           | 72,266              | 933.61            | 15,305                    | 1.1   | Yes                   |
| 622    | Outside Air Reduction       | 817                 | 333.59            | 7,758                     | 35.3  | Yes                   |
| (Libr) | Hot Water Temp Reduction    | 6                   | 2.19              | 51                        | 18.8  | Yes                   |
|        | Multi-Set Back              | 2,899               | 207.95            | 15,996                    | 6.3   | Yes                   |
|        | Enthalpy Economizer         | 3,667               | 218               | 5,073                     | 4.2   | Yes                   |
| 622    | Multi-Set Back              | 864                 | 59.04             | -                         | 6.0   | Yes                   |
| (Bowl) |                             |                     |                   |                           |       |                       |
| 624    | Hot Water Temp Reduction    | 6                   | 21.43             | 371                       | 218.2 | Yes                   |
|        | Piping Insulation           | 341                 | 56.33             | 1,115                     | 15.6  | Yes                   |
|        | Ceiling Insulation          | 2,665               | 195.36            | 3,386                     | 6.5   | Yes                   |
|        | Multi-Set Back              | 4,661               | 164               | 2,689                     | 3.1   | Yes                   |
|        | Roof Insulation             | 56,748              | 1108.08           | 19,204                    | 1.7   | Yes                   |
|        | Zone Control                | 9,045               | 124               | 2,033                     | 1.2   | Yes                   |
|        | Inside Insulation           | 72,266              | 861.71            | 14,934                    | 1.1   | Yes                   |
| 626    | Outside Air Reduction       | 191                 | 138               | 3,538                     | 62.8  | Yes                   |
|        | Air Volume Reduction        | 1,042               | 41                | 1,051                     | 2.8   | Yes                   |
|        | Multi-Set Back              | 9,837               | 182               | 4,513                     | 1.6   | Yes                   |
| 628    | Ceiling Insulation          | 2,697               | 177.99            | 28,252                    | 6.6   | Yes                   |
|        | MSB/ZC Combination          | 4,405               | 210               | 33,333                    | 4.9   | Yes                   |
| 630    | Zone Control                | 3,012               | 31.0              | 3,734                     | 1.1   | Yes                   |

Sum-7

TABLE 2

| Bldg. | Energy Conservation Measure | COST             | SAVINGS        |                           | SIR   | Feasible?<br>(Yes/No) |
|-------|-----------------------------|------------------|----------------|---------------------------|-------|-----------------------|
|       |                             | Const Costs (\$) | Annual MBTU/YR | BTU/FT <sup>2</sup><br>YR |       |                       |
| 632   | Zone Control/Multi-Set Back | 6,742            | 270.2          | 6,464                     | 3.5   | Yes                   |
|       | Ceiling Insulation          | 12,402           | 151.30         | 3,620                     | 1.1   | Yes                   |
| 635   | Ceiling Insulation          | 3,708            | 190.64         | 21,913                    | 4.5   | Yes                   |
| 639   | Multi-Set Back              | 425              | 1,489.4        | 42,676                    | 289.9 | Yes                   |
|       | Piping Insulation           | 183              | 10.64          | 304                       | 5.1   | Yes                   |
|       | Hot Water Temp Reduction    | 584              | 22.63          | 648                       | 3.4   | Yes                   |
|       | Ceiling Insulation          | 4,986            | 127.61         | 3,656                     | 2.2   | Yes                   |
|       | Enthalpy Economizer         | 4,002            | 126.8          | 3,633                     | 2.2   | Yes                   |
|       | Outside Air Reduction       | 534              | 9.4            | 269                       | 1.2   | Yes                   |
|       | Zone Control                | 53,285           | 716.04         | 20,517                    | 1.2   | Yes                   |
|       | Bay Door W/S                | 1,099            | 29.43          | 843                       | 1.2   | Yes                   |
| 648   | Multi-Set Back              | 1,585            | 277.00         | 27,700                    | 15.4  | Yes                   |
|       | Ceiling Insulation          | 17,426           | 662            | 66,200                    | 3.3   | Yes                   |
|       | Zone Control                | 2,010            | 64.00          | 6,038                     | 2.8   | Yes                   |
| 650   | Multi-Set Back              | 144              | 90.00          | 20,455                    | 64.6  | Yes                   |
|       | Duct Insulation             | 99               | 7.27           | 1,652                     | 6.5   | Yes                   |
|       | Ceiling Insulation          | 1,620            | 99.06          | 22,514                    | 6.3   | Yes                   |
|       | Piping Insulation           | 94               | 1.67           | 380                       | 1.7   | Yes                   |
|       | Inside Insulation           | 8,171            | 80.67          | 18,334                    | 1.0   | Yes                   |
| 652   | Piping Insulation           | 48               | 5.65           | 856                       | 11.1  | Yes                   |
|       | Ceiling Insulation          | 1,451            | 123.45         | 18,705                    | 8.8   | Yes                   |
|       | Inside Insulation           | 13,860           | 198.55         | 30,083                    | 1.5   | Yes                   |
|       | Personnel Door W/S          | 232              | 6.20           | 939                       | 1.4   | Yes                   |
| 654   | Piping Insulation           | 74               | 11.55          | 1,343                     | 14.7  | Yes                   |
|       | Ceiling Insulation          | 1,451            | 123.45         | 14,355                    | 8.8   | Yes                   |
|       | Inside Insulation           | 13,860           | 198.55         | 23,087                    | 1.5   | Yes                   |
|       | Personnel Door W/S          | 232              | 6.20           | 721                       | 1.4   | Yes                   |
|       |                             | Sum-8            |                |                           |       |                       |

TABLE 2

| Bldg. | Energy Conservation Measure | COST                | SAVINGS           |                           | SIR   | Feasible?<br>(Yes/No) |
|-------|-----------------------------|---------------------|-------------------|---------------------------|-------|-----------------------|
|       |                             | Const Costs<br>(\$) | Annual<br>MBTU/YR | BTU/FT <sup>2</sup><br>YR |       |                       |
| 655   | Hot Water Temp Reduction    | 6                   | 5.43              | 28                        | 49.0  | Yes                   |
|       | Multi-Set Back              | 10,609              | 2,712             | 14,125                    | 22.5  | Yes                   |
|       | Ceiling Fans                | 3,909               | 303.22            | 1,579                     | 6.9   | Yes                   |
|       | Enthalpy Economizer         | 5,724               | 451               | 2,349                     | 5.6   | Yes                   |
|       | Outside Air Reduction       | 1,000               | 62.7              | 326                       | 4.6   | Yes                   |
|       | CV to VAV                   | 45,423              | 2,030.4           | 10,575                    | 3.5   | Yes                   |
|       | Air Volume Reduction        | 95,395              | 2,752.34          | 14,335                    | 2.1   | Yes                   |
|       | Induction Kitchen Hood      | 33,798              | 791.00            | 4,120                     | 1.9   | Yes                   |
|       | Zone Control                | 90,603              | 1,581.2           | 8,235                     | 1.2   | Yes                   |
|       | Bay Door W/S                | 1,151               | 28.23             | 147                       | 1.1   | Yes                   |
|       | Heat Recovery               | 53,035              | 810.3             | 4,220                     | 1.0   | Yes                   |
| 656   | Piping Insulation           | 119                 | 16.22             | 2,534                     | 14.1  | Yes                   |
|       | Ceiling Insulation          | 1,451               | 123.45            | 19,289                    | 8.8   | Yes                   |
|       | Inside Insulation           | 13,860              | 198.55            | 31,023                    | 1.5   | Yes                   |
|       | Personnel Door W/S          | 232                 | 5.48              | 856                       | 1.3   | Yes                   |
| 658   | Ceiling Insulation          | 639                 | 40.25             | 15,481                    | 6.3   | Yes                   |
|       | Duct Insulation             | 51                  | 2.00              | 769                       | 3.5   | Yes                   |
| 662   | Multi-Set Back              | 940                 | 83.00             | 12,206                    | 9.1   | Yes                   |
|       | Ceiling Insulation          | 1,451               | 93.49             | 13,749                    | 6.4   | Yes                   |
|       | Piping Insulation           | 228                 | 6.17              | 907                       | 2.5   | Yes                   |
|       | Inside Insulation           | 13,860              | 145.46            | 21,391                    | 1.1   | Yes                   |
| 663   | Hot Water Temp Reduction    | 6                   | 16.56             | 180                       | 149.4 | Yes                   |
|       | Ceiling Fans                | 22,646              | 1,124.67          | 12,237                    | 4.5   | Yes                   |
| 664   | Multi-Set Back              | 144                 | 30                | 4,412                     | 21.5  | Yes                   |
|       | Piping Insulation           | 130                 | 23.22             | 3,415                     | 16.7  | Yes                   |
|       | Ceiling Insulation          | 1,451               | 91.45             | 13,449                    | 6.5   | Yes                   |
|       | Personnel Door W/S          | 174                 | 3.44              | 506                       | 1.1   | Yes                   |
|       | Inside Insulation           | 13,860              | 147.07            | 21,628                    | 1.1   | Yes                   |

Sum-9

TABLE 2

| Bldg. | Energy Conservation Measure | COST                | SAVINGS           |                           | SIR  | Feasible?<br>(Yes/No) |
|-------|-----------------------------|---------------------|-------------------|---------------------------|------|-----------------------|
|       |                             | Const Costs<br>(\$) | Annual<br>MBTU/YR | BTU/FT <sup>2</sup><br>YR |      |                       |
| 665   | Ceiling Insulation          | 16,907              | 1187.63           | 35,033                    | 6.2  | Yes                   |
|       | Inside Insulation           | 7,040               | 143.33            | 4,228                     | 1.8  | Yes                   |
| 666   | Multi-Set Back              | 144                 | 51.00             | 19,615                    | 38.7 | Yes                   |
|       | Ceiling Insulation          | 639                 | 37.47             | 14,412                    | 5.8  | Yes                   |
|       | Duct Insulation             | 85                  | 4.94              | 1,900                     | 5.1  | Yes                   |
| 667   | Hot Water Temp Reduction    | 12                  | 24.44             | 130                       | 84.8 | Yes                   |
|       | Outside Air Reduction       | 267                 | 18                | 96                        | 4.8  | Yes                   |
|       | Piping Insulation           | 158                 | 6.6               | 35                        | 3.7  | Yes                   |
|       | Multi-Set Back              | 71,883              | 1,122             | 6,543                     | 1.4  | Yes                   |
| 668   | Ceiling Insulation          | 1,619               | 102.13            | 24,910                    | 6.5  | Yes                   |
|       | Duct Insulation             | 72                  | 3.06              | 746                       | 3.7  | Yes                   |
|       | Piping Insulation           | 219                 | 3.36              | 820                       | 1.4  | Yes                   |
|       | Inside Insulation           | 8,144               | 84.30             | 20,561                    | 1.1  | Yes                   |
|       | Air Volume Reduction        | 3,443               | 23.00             | 5,610                     | 1.0  | Yes                   |
| 670   | Hot Water Temp Reduction    | 6                   | 2.08              | 184                       | 21.2 | Yes                   |
|       | Piping Insulation           | 340                 | 64.80             | 5,735                     | 19.7 | Yes                   |
|       | Zone Control                | 4,291               | 82                | 13,903                    | 2.0  | Yes                   |
| 671   | Multi-Set Back              | 863                 | 116.48            | 43,141                    | 11.9 | Yes                   |
|       | Ceiling Insulation          | 682                 | 39.98             | 14,807                    | 5.2  | Yes                   |
| 671A  | Multi-Set Back              | 863                 | 132.60            | 49,111                    | 13.5 | Yes                   |
|       | Ceiling Insulation          | 682                 | 37.81             | 14,004                    | 4.9  | Yes                   |
| 681   | Outside Air Reduction       | 267                 | 81.00             | 2,040                     | 26.4 | Yes                   |
|       | Multi-Set Back              | 1,436               | 297.00            | 7,481                     | 18.2 | Yes                   |
|       | Zone Control                | 7,216               | 133.00            | 3,350                     | 1.6  | Yes                   |

Sum-10

TABLE 2

| Bldg. | Energy Conservation Measure | COST                | SAVINGS           |                           | SIR  | Feasible?<br>(Yes/No) |
|-------|-----------------------------|---------------------|-------------------|---------------------------|------|-----------------------|
|       |                             | Const Costs<br>(\$) | Annual<br>MBTU/YR | BTU/FT <sup>2</sup><br>YR |      |                       |
| 684   | Piping Insulation           | 34                  | 3.49              | 1,058                     | 9.6  | Yes                   |
|       | Multi-Set Back              | 863                 | 52.56             | 15,927                    | 5.7  | Yes                   |
|       | Ceiling Insulation          | 638                 | 35.16             | 10,655                    | 5.1  | Yes                   |
|       | Duct Insulation             | 38                  | 0.91              | 276                       | 2.0  | Yes                   |
|       | Inside Insulation           | 8,171               | 86.62             | 26,248                    | 1.0  | Yes                   |
| 685   | Hot Water Temp Reduction    | 6                   | 5.21              | 82                        | 53.0 | Yes                   |
|       | Air Volume Reduction        | 727                 | 190.00            | 2,547                     | 18.5 | Yes                   |
|       | Piping Insulation           | 356                 | 58.48             | 925                       | 15.4 | Yes                   |
|       | Ceiling Insulation          | 6,357               | 744.34            | 11,778                    | 10.1 | Yes                   |
|       | Enthalpy Economizer         | 1,797               | 254.00            | 4,019                     | 10.0 | Yes                   |
|       | Induction Kitchen Hood      | 6,185               | 216.41            | 3,424                     | 3.1  | Yes                   |
|       | High Efficiency Fluorescent | 43,989              | 964.2             | 15,257                    | 1.2  | Yes                   |
|       | Multi-Set Back              | 35,404              | 452.00            | 7,152                     | 1.1  | Yes                   |
| 687   | Pipe Insulation             | 369                 | 24.93             | 394                       | 5.95 | Yes                   |
|       | Ceiling Insulation          | 40,785              | 631.21            | 9,987                     | 1.4  | Yes                   |
|       | Inside Insulation           | 62,854              | 722.54            | 11,432                    | 1.0  | Yes                   |
| 689   | Multi-Set Back              | 431                 | 208.25            | 22,392                    | 42.5 | Yes                   |
| 692   | Multi-Set Back              | 863                 | 109.01            | 31,146                    | 13.1 | Yes                   |
|       | Boiler Replacement          | 4,071               | 40.61             | 11,603                    | 1.0  | Yes                   |
| 693   | Ceiling Insulation          | 2,642               | 155.60            | 19,949                    | 6.1  | Yes                   |
|       | Multi-Set Back              | 1,806               | 96.62             | 12,387                    | 5.5  | Yes                   |
|       | Boiler Replacement          | 4,071               | 91.31             | 11,706                    | 1.6  | Yes                   |
|       | Inside Insulation           | 18,265              | 240.29            | 30,806                    | 1.4  | Yes                   |

TABLE 2

| Bldg.        | Energy Conservation Measure                       | COST                | SAVINGS           |                           | SIR   | Feasible?<br>(Yes/No) |
|--------------|---|---------------------|-------------------|---------------------------|-------|-----------------------|
|              |   | Const Costs<br>(\$) | Annual<br>MBTU/YR | BTU/FT <sup>2</sup><br>YR |       |                       |
| 705          | Multi-Set Back                                    | 3,417               | 2,749.38          | 64,539                    | 83.2  | Yes                   |
|              | Piping Insulation                                 | 27                  | 3.73              | 88                        | 13.0  | Yes                   |
| 705A         | Multi-Set Back                                    | 3,417               | 1,418.49          | 43,503                    | 42.9  | Yes                   |
| 706          | Personnel Door W/S                                | 123                 | 7.36              | 898                       | 3.3   | Yes                   |
| 719          | Outside Insulation                                | 17,238              | 211.65            | 50,393                    | 1.1   | Yes                   |
| 720          | Piping Insulation                                 | 432                 | 90.56             | 2,736                     | 18.4  | Yes                   |
|              | Multi-Set Back/Zone Control                       | 57,612              | 715.88            | 21,628                    | 1.1   | Yes                   |
| 721          | Ceiling Insulation                                | 75                  | 10.64             | 1,935                     | 14.5  | Yes                   |
|              | Piping Insulation                                 | 81                  | 9.86              | 1,793                     | 12.6  | Yes                   |
|              | Inside Insulation                                 | 4,690               | 180.36            | 32,793                    | 4.0   | Yes                   |
|              | Bay Door W/S                                      | 1,454               | 57.69             | 10,489                    | 2.1   | Yes                   |
| 727          | Hot Water Temp Reduction                          | 18                  | 25.62             | 66                        | 64.2  | Yes                   |
|              | Air Volume Reduction and<br>Outside Air Reduction | 44,775              | 24,051.75         | 62,037                    | 49.5  | Yes                   |
| 733          | Multi-Set Back                                    | 861                 | 82.87             | 18,015                    | 9.9   | Yes                   |
| 745<br>(A&B) | Air Volume Reduction &<br>Outside Air Reduction   | 11,011              | 3,747.82          | 3,859                     | 29.8  | Yes                   |
|              | Heat Recovery                                     | 20,332              | 782.92            | 806                       | 3.4   | Yes                   |
|              | Induction Kitchen Hood                            | 289,971             | 6,489.43          | 6,682                     | 2.0   | Yes                   |
| 751          | Hot Water Temp Reduction                          | 6                   | 28.89             | 232                       | 260.6 | Yes                   |

TABLE 2

| Bldg.  | Energy Conservation Measure                       | COST                | SAVINGS           |                           | SIR  | Feasible?<br>(Yes/No) |
|--|---|---------------------|-------------------|---------------------------|------|-----------------------|
|  |   | Const Costs<br>(\$) | Annual<br>MBTU/YR | BTU/FT <sup>2</sup><br>YR |      |                       |
| 752  | Outside Air Reduction                             | 15,385              | 3,596.56          | 18,673                    | 20.4 | Yes                   |
|  | Air Volume Reduction                              | 2,457               | 390.26            | 2,026                     | 11.6 | Yes                   |
|  | Enthalpy Economizer                               | 6,036               | 156.40            | 812                       | 2.1  | Yes                   |
|  | Ceiling Insulation                                | 21,916              | 369.66            | 1,919                     | 1.5  | Yes                   |
|  | Inside Insulation                                 | 211,188             | 3,419.58          | 17,755                    | 1.4  | Yes                   |
| 753  | Multi-Set Back                                    | 15,877              | 9,416.7           | 45,823                    | 52.2 | Yes                   |
|  | Air Volume Reduction and<br>Outside Air Reduction | 10,573              | 1,580.45          | 7,690                     | 12.6 | Yes                   |
|  | Ceiling Insulation                                | 5,052               | 385.30            | 1,875                     | 6.5  | Yes                   |
| 756  | Hot Water Temp Reduction                          | 6                   | 6.25              | 20                        | 56.4 | Yes                   |
|  | Floor Insulation                                  | 6,171               | 120.28            | 394                       | 1.7  | Yes                   |
|  | Zone Control*                                     | 85,520              | 1,195             | 3,915                     | 1.2  | Yes                   |
|  | Multi-Set Back                                    | 275,415             | 3,841             | 12,585                    | 1.2  | Yes                   |
| * "Zone Control" duplicated in "Multi-Set Back" project. |   |                     |                   |                           |      |                       |
| 757  | Hot Water Temp Reduction                          | 6                   | 3.61              | 34                        | 32.6 | Yes                   |
|  | Air Volume Reduction and<br>Outside Air Reduction | 14,032              | 4,335.55          | 41,290                    | 25.7 | Yes                   |
|  | Multi-Set Back                                    | 10,726              | 1,892.11          | 18,020                    | 14.3 | Yes                   |
| 759  | Hot Water Temp Reduction                          | 6                   | 3.89              | 360                       | 33.0 | Yes                   |
|  | Ceiling Insulation                                | 3,546               | 83.73             | 7,753                     | 2.0  | Yes                   |
|  | High Efficiency Fluorescent                       | 812                 | 18.7              | 1,731                     | 1.3  | Yes                   |
| 783  | Ceiling Insulation                                | 3,889               | 593.05            | 74,131                    | 13.4 | Yes                   |
|  | Multi-Set Back                                    | 431                 | 36.72             | 4,590                     | 7.5  | Yes                   |
| 785  | Ceiling Insulation                                | 5,145               | 363.43            | 18,734                    | 7.3  | Yes                   |
|  | Multi-Set Back                                    | 9,216               | 241.3             | 12,438                    | 2.7  | Yes                   |

TABLE 2

| Bldg. | Energy Conservation Measure                       | COST                | SAVINGS           |                           | SIR   | Feasible?<br>(Yes/No) |
|-------|---|---------------------|-------------------|---------------------------|-------|-----------------------|
|       |   | Const Costs<br>(\$) | Annual<br>MBTU/YR | BTU/FT <sup>2</sup><br>YR |       |                       |
| 793   | Heat Recovery                                     | 111,051             | 1,342             | 55,226                    | 1.1   | Yes                   |
| 795   | Heat Recovery                                     | 111,051             | 1,343             | 55,262                    | 1.1   | Yes                   |
| 900   | Multi-Set Back                                    | 1,412               | 3,792.4           | 26,896                    | 213.2 | Yes                   |
|       | Air Volume Reduction and<br>Outside Air Reduction | 18,638              | 14,370.27         | 101,916                   | 60.4  | Yes                   |
|       | Optimize Off Coil Temp                            | 56,339              | 7,435.3           | 52,732                    | 11.6  | Yes                   |
|       | Enthalpy Economizer                               | 24,145              | 1,548.4           | 10,981                    | 5.5   | Yes                   |
|       | Induction Kitchen Hood                            | 59,272              | 1,912.65          | 13,564                    | 2.9   | Yes                   |
|       | Bay Door W/S                                      | 767                 | 34.99             | 248                       | 2.1   | Yes                   |
|       | Heat Recovery                                     | 11,080              | 229.30            | 1,626                     | 1.9   | Yes                   |
|       | CV to VAV   | 900,000             | 21,305.38         | 151,101                   | 1.8   | Yes                   |
|       | High Efficiency Fluorescent                       | 147,016             | 3,821             | 27,099                    | 1.4   | Yes                   |
| 901   | Multi-Set Back                                    | 431                 | 20.19             | 2,804                     | 4.8   | Yes                   |



SUMMARY OF RESULTS OF  
FEASIBLE PROJECTS PACKAGED AS 1391 OR 4283

| Priority No. | Energy Conservation Opportunity Title             | No. of Bldgs. Affected | Construction Cost (X \$1,000) | Annual Savings |                  | Overall SIR | Document Type |
|--------------|---|------------------------|-------------------------------|----------------|------------------|-------------|---------------|
|              |   |                        |                               | Energy (MBTU)  | Cost (X \$1,000) |             |               |
| 1            | Outside Air & Air Volume Reduction                | 17                     | 263                           | 65,804         | 425              | 20.8        | 1391          |
| 2            | Hot Water Temperature Reduction                   | 17                     | 0.7                           | 213            | 1                | 14.3        | 4283          |
| 3            | Optimize Off-Coil Temperature                     | 1                      | 56                            | 7,435          | 47               | 11.6        | 1391          |
| 4            | Pipe Insulation                                   | 19                     | 4                             | 480            | 3                | 10.7        | 4283          |
| 5            | Ceiling Fans                                      | 2                      | 27                            | 1,428          | 9                | 4.8         | 1391          |
| 6            | Duct Insulation                                   | 5                      | 0.3                           | 18             | 0.1              | 4.6         | 4283          |
| 7            | Enthalpy Economizer                               | 8                      | 84                            | 4,480          | 29               | 4.3         | 1391          |
| 8            | Zone Control/ Multiple Set Back                   | 38                     | 751                           | 36,405         | 247              | 4.3         | 1391          |
| 9            | Ceiling/Roof Insulation                           | 30                     | 190                           | 7,745          | 53               | 3.7         | 1391          |
| 10           | Induction Kitchen Hood                            | 5                      | 411                           | 11,128         | 70               | 2.4         | 1391          |
| 11           | Constant Volume to Variable Air Volume Conversion | 2                      | 945                           | 23,336         | 156              | 1.9         | 1391          |
| 12           | Boiler Replacement                                | 2                      | 8                             | 132            | 1                | 1.7         | 4283          |
| 13           | Floor Insulation                                  | 1                      | 6                             | 120            | 0.8              | 1.7         | 1391          |
| 14           | Bay Door & Personnel Door Weatherstripping        | 9                      | 5                             | 179            | 1                | 1.6         | 4283          |

| Priority No. | Energy Conservation Opportunity Title | No. of Bldgs. Affected | Construction Cost (X \$1,000) | Annual Savings Energy (MBTU) | Annual Savings Cost (X \$1,000) | Overall SIR | Document Type |
|--------------|---------------------------------------|------------------------|-------------------------------|------------------------------|---------------------------------|-------------|---------------|
| 15           | Lighting Modifications                | 4                      | 197                           | 4,962                        | 34                              | 1.4         | 1391          |
| 16           | Inside/Outside Wall Insulation        | 17                     | 592                           | 8,223                        | 56                              | 1.4         | 1391          |
| 17           | Heat Recovery                         | 5                      | 298                           | 4,508                        | 28                              | 1.3         | 1391          |
|              | TOTAL                                 |                        | 3,838                         | 176,596                      | 1,161                           |             |               |

3.3

10,9.2